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**Performance Demonstration:
UH-60Q External Rescue Hoist
and Cargo Loadmeter**

By

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and

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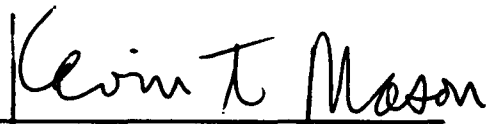
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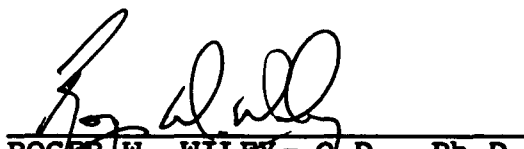

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Introduction

The UH-60Q prototype MEDEVAC Black Hawk is configured to provide day/night, adverse weather, emergency movement of patients. The Materiel Need Statement for the UH-60Q directs that the aircraft be capable of performing medical evacuation in several mission profiles (Department of the Army, 1992). These include Southwest Asia, Europe, MAST, and Persian Gulf scenarios that are summarized in Appendix A. The U.S. Army Aeromedical Research Laboratory (USAARL) was tasked by the Utility Helicopter Program Manager to evaluate the UH-60Q prototype aircraft in flights that simulate the typical mission profiles. This information is needed to determine functional requirements for future operational and user tests of the UH-60Q. This report details the results of performance demonstrations of the external rescue hoist and cargo loadmeter on the UH-60Q prototype. An analysis of other features of the medical interior and details on the performance of the aircraft system in mission scenarios is detailed in other reports.

The UH-60 aircraft, serial number 86-24560, is configured as the Proof of Principle Aircraft YUH-60A(Q). This helicopter is equipped with an enhanced medical interior, enhanced avionics and visual displays, and an externally-mounted rescue hoist.

The objective of this report is to describe the results of performance demonstrations for the rescue hoist and cargo loadmeter. The specific purpose was to determine if the current procedures and crew configuration for a MEDEVAC Black Hawk could be adapted to operate these modified systems on the prototype aircraft. This information will be useful to the Utility Helicopter Project Manager when evaluating how each component of the medical interior enhances or degrades the ability of a typical flight medic to perform his duties.

Materials and methods

External rescue hoist

The rescue hoist system on the prototype aircraft is an electrically powered external rescue hoist capable of lifting a maximum load of 600 pounds with a usable cable length of 290 feet. The hoist is controlled by the hoist operator using a pendant which also allows for digital readout of cable deployed, intercom, and crew searchlight operations. The digital readout also is displayed in the cockpit where a cable shear system is present for emergency override. The external rescue hoist is shown in Figure 1.

There were no formal procedures, manuals, or training program available for operating the external rescue hoist system. Typical rescue hoist operations were undertaken by instructors from the U.S. Army School of Aviation Medicine acting as aircraft and ground crew. The hoist loads included two 250-lb manikins, each loaded into a Stokes or Skedco litter. No live entities were hoisted in accordance with a limitation of the airworthiness release



Figure 1. External rescue hoist on the prototype aircraft.

for the aircraft. The hoist operations were completed over an open field, in daylight, with the aircraft hovering at 50 feet above ground level. The aircraft was configured with external stores including a 230-gallon auxiliary fuel cell on each side at the outboard station. Each type of litter was lifted twice, by two different crew combinations, and loaded onto the litter lift system. The plan for the hoist performance demonstration included repeating the hoist operations with a different manufacturer hoist at night. Several days after the daylight hoist operations, a problem identified by the aircraft squib test for the hoist release system prevented night hoist operations.

Cargo hook loadmeter

The cargo hook weighing system (CHWS) is designed to monitor external loads carried on the helicopter cargo hook. The system consists of a load sensor integral to the cargo hook and a cockpit-mounted, NVG compatible, digital display. The system displays the weight of the load on the cargo hook to the pilot and copilot.

Typical cargo load operations were accomplished by instructors from the U.S. Army School of Aviation Medicine acting as aircraft guides and Pathfinders from A Co., 511th

acting as ground guide and loadmaster. The cargo load operations were completed in daylight, over an open field, and with a 1200-lb load.

Results

The hoist operations were completed using personnel representing a typical MEDEVAC Black Hawk crew. The external cargo loading operations were completed with a similar crew configuration.

Discussion

The hoist operations in the prototype aircraft could be completed with the current crew configuration. The hoist operator attempted to operate the hoist from the crew seat, but was not able to observe the hoist cable as it was lowered to the ground without wearing a safety harness and sitting at the edge of the door. The ground procedures for hoist operations were unchanged with this aircraft. The hoist operators and flight crew said that the digital readout of the hoist cable assisted them in following the progress of the hoist operation (improved situational awareness). A typical hoist is shown with a Skedco litter in Figure 2.

The hoisted litter bumps the tire as it approaches the landing gear. The hoist operators had to use their feet to push the load outward from the aircraft. When the litter reached the doorway, the "foot" of the litter would not clear the forward edge of the cargo door (loading feet first). The hoist operator has to pull the load toward the tail of the aircraft to clear the doorway and external stores support system. The litter drags on the forward bulkhead where the controls for the medical interior are located. One of the test lights was broken during hoist operations by the litter striking this panel. This problem may be reduced if the control panel is guarded. Hoist operations also would be simplified if the hoist was located several inches aft. Hands-on training may be required for hoist operators to become comfortable with operation of the pendant. The hoist operators found that they had to raise and lower the hoist in small increments to bring the litter into the aircraft and slide it onto the litter lifts. The presence of litter lifts eased operations by providing a flat surface (litter pan), near the floor, to place the hoisted load. Placing the hoisted litter onto an immovable upper litter tray would be very difficult. The VOX circuit in the intercom was unusable for hands-off hoist operations. The loud ambient noise, with the open aircraft door, constantly opens the VOX circuit.

The cargo loading procedures are essentially unchanged by the presence of the cargo loadmeter. The aircraft crew stated that the loadmeter provided valuable information on the status of the external load. They found the digital load reading was within 10 pounds of the weight of the test block. A photograph of the prototype aircraft performing a cargo lift is shown in Figure 3.



Figure 2 Prototype aircraft hoisting a Skedco litter.



Figure 3. Prototype aircraft lifting an external cargo load.

Summary

External hoist and cargo load operations can be completed in the prototype aircraft with a typical MEDEVAC Black Hawk crew. The hoist operator is not able to operate the hoist from the crew seat. He had to push the litter clear of the aircraft tire and pull the weight of the litter aft to load it into the aircraft.

The external cargo loading procedures essentially are unchanged with the addition of the cargo loadmeter. The aircraft crew stated that the loadmeter provided valuable information on the status of the external load.

References

Department of the Army. 1992. Appendix 1, UH-60A Black Hawk materiel need, production, dated 1979, (MN) (P) for Dustoff Black Hawk (UH-60Q).

Department of the Army. 1979. UH-60A Black Hawk Materiel Need, Production, dated 1979 (MN) (P)

Appendix A.
Mission profile summaries.

A. AEROMEDICAL EVACUATION (SOUTHWEST ASIA). The UH-60Q, collocated with a forward support medical company in direct support to a maneuver brigade, receives a mission to transport a trauma treatment team from the forward support medical company forward to a battalion aid station and then evacuate six litter patients and one ambulatory patient from the battalion aid station to the division clearing station located in the brigade support area (BSA). The UH-60Q departs the BSA with the trauma treatment team and flies at an airspeed of 120 knots using contour flight technique for 67 nautical miles (nm) and then slows to an airspeed of 30 knots using NOE flight technique for the last 3 nm to the battalion aid station. The trauma treatment team is off-loaded and the patients are loaded into the aircraft. (20 minutes allocated for loading and unloading) The UH-60Q departs the battalion aid station using NOE for the first 3 nm and then transitions to contour flight for the remaining 67 nm to the BSA. The patients are off-loaded at division clearing station (10 minutes allocated) at which time the aircraft is ready for the next mission. Total time for the mission, to include patient loading and unloading times, is approximately 118 minutes.

Event	Distance (nm)	Speed (kts)	Flight mode	Time (min)
1 - 2	70	120/30	LL/NOE	44
Load patients			Landed	20
2-3	70	30/120	NOE/LL	44
Unload patients			Landed	10
TOTAL	140			118 (1.9 hr)

B. AEROMEDICAL EVACUATION (MAST). A UH-60Q located at a military installation receives a night MAST mission to transfer two patients involved in a traffic accident from a small community hospital to a medical center capable of providing life saving (definitive) medical treatment. The gaining hospital requests the mission and provides two nurses and a critical care physician to assist in the enroute care of the patients. The weather is marginal but acceptable. The small community does not have an airport or weather reporting capability and is not situated along the FAA enroute and terminal flight system. After premission planning, the crew flies to the medical center (8 nm, 125 kts, low level) to pick up additional health care providers (5 minutes for loading). The crew uses onboard navigational equipment to locate and fly to the community hospital (80 nm, 120 to 145 kts, contour or low level). Unforecast weather was encountered at the pickup site. After landing, the health care team goes into the hospital to obtain patient briefings and execute transfer of patient responsibility (10 minutes for loading). The physician and the medic attend the adult patient while the nurses attend the baby.

Once loaded, the crew departs for the medical center. The patients require constant enroute treatment and monitoring on the return flight. The health care providers must use white light to provide appropriate care and must talk back and forth constantly. The female patient's condition deteriorates requiring the physician to contact the medical center to alert the operating room personnel of the requirement for immediate surgery upon arrival. Upon landing at the hospital helipad, the patients are off loaded and moved into the hospital. The flight crew returns to the military installation (8 nm) and mission is complete. Total mission time is 2 hours.

Event	Distance (nm)	Speed (kts)	Flight mode	Time (min)
1 - 2	8	125	LL	5
Load personnel			Landed	5
2-3	80	120-145	LL	40
Load patients			Landed	10
3-4	80	145	LL	35
Offload patients			Landed	10
4-5	8	125	LL	5
TOTAL	176			120 (2 hr)

C. AEROMEDICAL EVACUATION (PERSIAN GULF). Low level flight for a distance of 200 nm with an airspeed of 110 to 120 kts. Hoist rescue from a hover of less than 70 feet (25 minutes allowed) followed by 170 nm low level flight at 110 to 120 nm. At this point, the patients are offloaded and the aircraft flies 50 nm (low level) at an airspeed of 110 to 120 kts.

Event	Distance (nm)	Speed (kts)	Flight mode	Time (min)
1 - 2	200	110-120	LL	120
Rescue			Hover	25
2-3	170	110-120	LL	105
Unload patients			Landed	
3-4	50	110-120	LL	25
Offload patients			Landed	10
TOTAL	420+			275-305 (5.1 hr)

Adapted from Annex B, Appendix 1, UH-60A Black Hawk Materiel Need, Production, dated 1979 (MN) (P)

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